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***PHOTURIS MYSTICALAMPAS* (COLEOPTERA:
LAMPYRIDAE): A NEW FIREFLY FROM PEATLAND
FLOODPLAIN FORESTS OF THE DELMARVA
PENINSULA¹**

Christopher M. Heckscher²

ABSTRACT: *Photuris mysticalampas* sp. nov., is described herein. This species can be distinguished from other Photurids by the combination of its small size, oval body shape, the dense pubescent appearance of the elytra, and flash pattern. Adults emerge at night from *Sphagnum* spp. hummocks in acidic peatland floodplain forests and fly slowly among dense understory vegetation at <2m height. Typical flash pattern is a slow signal (0.4 - 0.8 sec) of moderate luminosity for a *Photuris* repeated at 3 - 7 sec intervals. The species is known only from three sites in two watersheds in Sussex County, Delaware.

KEY WORDS: Delaware, Delmarva Peninsula, Lampyridae, peatland invertebrates, *Photuris*, *Photuris mysticalampas*

The Lampyrid genus *Photuris* has a wide distribution in the Western Hemisphere (e.g., Barber, 1951; Rosa, 2007). Eleven species have been documented from the state of Delaware, USA (Heckscher, 2010). One of these noted as *P. SPH* in Heckscher (2010) is herein described as *P. mysticalampas* (Fig. 1). This species was first recognized as lacking formal description in 2005 during a collecting trip to the Nanticoke River floodplain in Sussex County, Delaware (Chesapeake Bay estuary). Collections were made at the original site of discovery in 2005, 2008, 2010, and 2011, and at an additional site in 2008. Subsequent examination of an unidentified *Photuris* specimen collected by the author in 2004 at Prime Hook National Wildlife Refuge, Sussex County, Delaware (Delaware Bay estuary), was found to represent the first known collected specimen of *P. mysticalampas* and a third recognized location for this species. The species has only been observed at three sites in two watersheds (Chesapeake and Delaware basins) in Sussex County, Delaware. Adults emerge well after sunset from *Sphagnum* spp. hummocks in acidic peatland floodplain forests.

Diagnosis of this species may be simpler than most *Photuris*. In the Middle-Atlantic region, *P. mysticalampas* may at first appear morphologically similar to three other freshwater wetland-associated species of similar size: *P. bethaniensis* McDermott, *P. pennsylvanica* (DeGeer), and *P. hebes* Barber. However, it can be distinguished by its pronounced oval body shape (large width-to-length ratio) and densely pubescent elytra (Fig. 2). In addition, the flash pattern differs from all other Mid-Atlantic *Photuris*: typical flash is a single long and almost imperceptible crescendo of medium luminosity. In contrast, *P. bethaniensis* produces a

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flash of similar color but it is more rapid, of greater brilliance, and usually of two components (McDermott, 1953). Flash patterns of *P. pennsylvanica* and *P. hebes* differ as well: *Photuris pennsylvanica* usually emits a diagnostic double-flash pattern (dot-flash pattern; Barber, 1951) or sometimes a single two-part flash pattern generally brighter than *P. mysticalampas* (see Lloyd, 1980), and *P. hebes* emits a rapid flash usually of rather low luminosity (Barber, 1951; McDermott, 1967). Further, in this region *P. bethaniensis* is restricted to interdunal wetland swales (Heckscher and Bartlett, 2004) and is not expected to be sympatric with *P. mysticalampas*. However, at the type locality *P. pennsylvanica* and *P. hebes* occur in sympatry with *P. mysticalampas*. Finally, *P. mysticalampas* differs from all three similar species in various combinations of morphological characters and behavior presented below.

Photuris mysticalampas, Heckscher NEW SPECIES

Specimens examined: Holotype (USNM barcode number USNMENT 00802651): ♂: "USA: DEL, Sussex Co., Nanticoke Wildlife Area, Phillips Landing Trail, Atlantic white cedar [*Chamaecyparis thyoides*] swamp, 10-VII-2008, Col: C. M. Heckscher." Paratypes from all three known locations: 16♀♀; 15♂♂. Paratypes have been placed in the USNM ($n = 6$), the collection of J. E. Lloyd at the University of Florida ($n = 5$), and retained in the voucher collection of C. M. Heckscher currently located at Delaware State University.

General description: A small, noticeably oval-shaped Photurid averaging smaller than *P. bethaniensis* (range: 8.2 -10.5mm; mean: $9.2 \pm \text{SE } 0.7\text{mm}$) inhabiting sphagnum hummocks in peatland floodplain forests. Elytra light brown to grey with pubescence unusually dense. Vittae are pale, ill-defined, and run approximately 0.75 the length of the elytra. Antennae are of average length for a *Photuris*, about 0.5 the length of the body. Pronotal mark is rather broad, uninterrupted, with diffuse edges.

Diagnosis: Separated from congeners by the combination of small size, compact oval body outline, pubescent appearance of the elytra, and flash pattern. To date, the species has not been observed outside of peatland floodplain forest.

Pronotum: Scutate or semicircular and finely punctate; somewhat pubescent particularly along basal edge; posterior lateral corners rounded and somewhat produced. Basal edge of pronotum with pronounced undulation vertically and sinuous on horizontal plane with posterior lateral corners raised forming a ridge that extends at an oblique angle toward center of pronotum. Orange pigmentation somewhat restricted resulting in pronounced translucent margins; central black mark usually broad, pronounced, yet borders ill-defined, somewhat constricted centrally but in all specimens remains uninterrupted; apical end of the mark is slightly wider than the mark's base; base of mark barely reaching basal edge of pronotum and lateral edges not appreciably extended and sometimes as narrow as the central constriction (Fig. 3). The pronotal mark on most specimens appears similar to the holotype (Fig. 1), rather than the two extremes shown in



Fig. 1. Habitus of *Photuris mysticalampas* (male; holotype).

Figure 3. Distance between posterior lateral corners along basal edge 2.2 - 2.9 mm (mean: 2.5, SE \pm 0.2, n = 29), central longitudinal length from apex to basal edge 1.3 - 2.2 mm (mean: 1.75, SE \pm 0.2, n = 29).

Elytra: Compared to congeners, of generally greater pubescence due to lengthy setae (Fig. 2). Length 6.5 - 8.5 mm (mean: 7.4, SE \pm 0.6; n = 29), width at 0.5 the length of the elytra 3.2 - 4.4 mm (mean: 3.7, SE \pm 0.25, n = 29). Margins sub-parallel giving an oval body outline; color light brown to grey, paler than *P. bethaniensis* and *P. hebes*, similar to *P. pennsylvanica*. Vittae pale, without sharp definition, mostly translucent, extending 0.75 the length of the elytra fading distally, apical end not quite reaching the humerus. Lateral margins pronounced, translucent, and same color as vittae; sutural margins very narrow or absent and when present are not continuous around distal tip of elytra.

Antennae: Dark brown to black; articulations ivory to pale grey. Length: 4.3 - 5.2 mm (mean: 4.7 SE \pm 0.33; n = 7). Length about 0.51 total length of the body.

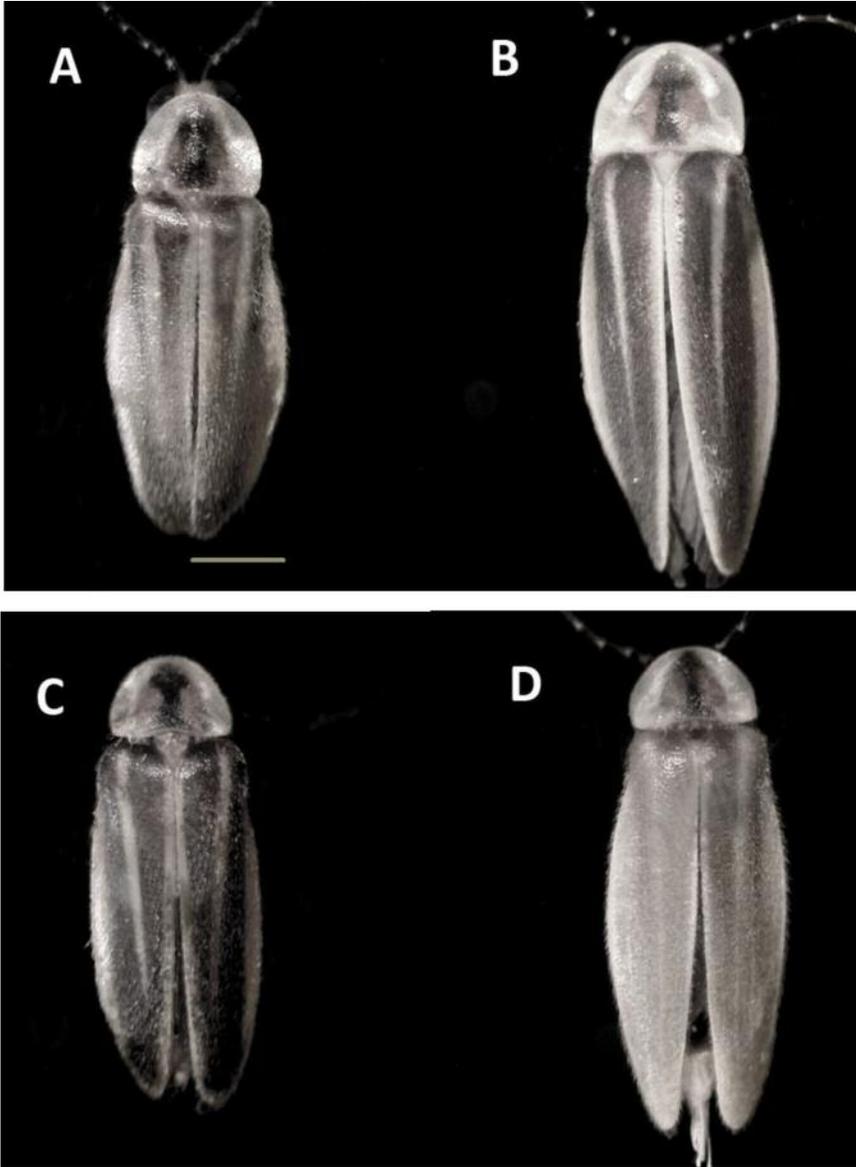


Fig. 2. Habitus of (A) *Photuris mysticalampas* (male; holotype), (B) *P. hebes* (male; Kent Co., DE), (C) *P. bethaniensis* (male; Sussex Co., DE), and (D) *P. pennsylvanica* (male; Sussex Co., DE) showing the oval body shape and dense pubescent elytra of *P. mysticalampas* in comparison to the more elongated and less pubescent appearance of three other congeners of similar size in the Middle-Atlantic region (scale bar 2mm).

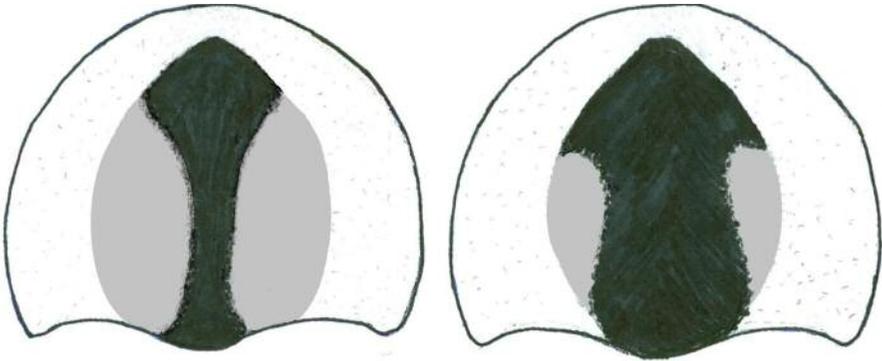


Fig. 3. Sketches of the *Photuris mysticalampas* pronotum to illustrate the two extreme endpoints in the variation of the central pronotal mark based on the examination of 31 specimens from three different populations. Most individuals are between the two extremes and resemble the holotype (see text).

Scutellum: Scutellum triangular, yellow, and terminating in a comparatively sharp posterior apex. Mesonotal plates yellow.

Head: Frons yellow; inner edges of male antennal sockets <0.1mm apart. Maxillary palpi brown. Mandibles light brown. Clypeus light brown with three insignificant projections.

Ventrites: First four visible ventrites light brown, the posterior apex of the fourth ventrite white up to 0.8 the length of the ventrite with lateral sides of the fourth ventrite mostly brown to the posterior edge, the white portion of the ventrite therefore forming a semi-circle on most specimens. Fifth and sixth visible ventrites white. Posterior edge of the sixth ventrite sinuate with a single indentation in males, straight in females.

Legs: Femur and tibia usually pale yellow with a dusting of grey pubescence particularly prominent on the distal half of tibia. In some specimens, the distal end of tibia and distal half of femur is brown rather than yellow. In comparison to congeners of similar size (*P. pennsylvancia*, *P. hebes*, *P. bethaniensis*), tarsomeres are covered with dense long setae. Penultimate tarsomere >50% the length of the terminal segment – with the dense setae this gives the appearance of a short and reduced terminal tarsomere and claw in comparison to congeners. Fourth tarsomere with relatively inconspicuous lobes compared to most other Photurids. The first tarsomere on the hind leg is about the same length as the second and third tarsomeres, combined. The coxae are yellow.

Thorax: Mostly light brown.

Male aedeagus: Similar to other *Photuris* fireflies; no diagnostic characters are recognized herein for *P. mysticalampas*. Lateral lobes approximately 1 mm in length beyond basal piece. Filaments extending distally from basal piece to beyond end of lateral lobes. Lateral lobes each cylindrical in shape but laterally

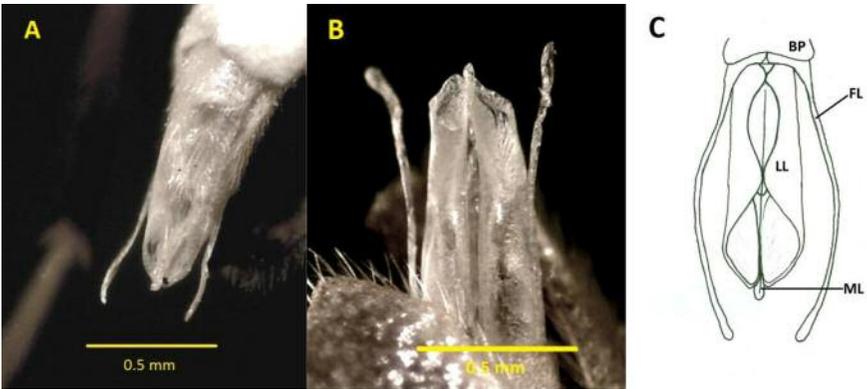


Fig. 4. Aedeagus of *Photuris mysticalampas*: (A) ventral, (B) dorsal, (C) ventral diagram showing some general features: BP, basal piece; FL, filament; LL, lateral lobe; ML, median lobe.

compressed – the outer edges appearing roughly parallel. Median piece usually visible on ventral side and often extending beyond distal tip of lateral lobes (Fig. 4).

Flash pattern: Typically, at 28 - 30°C, a single flash consisting of a slight crescendo of 0.4 - 0.8 sec., usually with a 3 - 7 sec interval (intervals can be much longer). Occasional signals may last more than 1.0 sec. Usual perceived color is more green than yellow; however, some signals appear yellow. The signal is not brilliant, instead, of medium luminescence for *Photuris*. Females have been observed giving short multiple weak flashes from vegetation when signaling to males. On rare occasions, males have been observed giving a momentary trembling green flash when moving rapidly through vegetation toward a signaling female.

Type Locality: Nanticoke River floodplain, south of Phillips Landing, Sussex County, Delaware (38° 33' 48" N, 75° 40' 36" W).

Etymology: From Latin, a combination of *Mystica*, meaning of a mysterious or mystical aura, and *lampas* meaning torch, flame, or lantern. Named for the surreal appearance of the adult fireflies which, when signaling in large numbers, are reminiscent of distant torches or lanterns turning slowly on and off strewn throughout the dense forest understory.

Further remarks:

Extreme flight dates from collections at the type locality: 28 June 2011 and 22 July 2010. The flight period may end abruptly as only one individual was observed at the type locality on 22 July 2010.

Behavior: Behaviorally, this species is unlike other Mid-Atlantic *Photurids*. Adults emerge 30 - 40 min after sunset from sphagnum covered hummocks. Males typically patrol dense floodplain understory at <2m despite occurring in

mature floodplain forest with canopies of 20 - 25m. Males on the wing navigate dense vegetation very slowly while signaling. Females usually remain on low vegetation at <1m while signaling to approaching males. Despite flying slowly, once captured, both males and females crawl very rapidly unlike other Middle-Atlantic Photurids.

Habitat characteristics: Humid acidic peatlands of floodplain forests of high ecological quality with a dense vegetated understory and thick sphagnum hummocks (Fig. 5). Two sites, including the type locality, are a tidal freshwater floodplain forest codominated by *Chamaecyparis thyoides* (L.). The third known location is a freshwater floodplain peatland forest of minimal tidal influence dominated by dense shrubs and a broken hardwood forest canopy. At the type locality adults emerge from sphagnum hummocks.



Fig. 5. The type locality of *Photuris mysticalampas* showing the forested peatland floodplain with dense understory. The forest canopy is comprised of a mix of hardwood species co-dominated by *Chamaecyparis thyoides*. The dense vegetation is interspersed with *Sphagnum* spp. hummocks from which adult *P. mysticalampas* were observed emerging.

Distribution and conservation status: To date, this species is known from three sites and two watersheds in a single county in Delaware. Two sites occur within one kilometer in floodplain forests of the Nanticoke River and Broad Creek, Chesapeake watershed. The other site is at Prime Hook National Wildlife Refuge, Delaware Bay watershed, and is disjunct from the type locality by 44 km. Its association with tidal freshwater floodplains indicates known populations

of *P. mysticalampas* are immediately threatened with sea-level rise. This species should be looked for in similar high-quality forested freshwater floodplain peatlands of New Jersey, Maryland, Virginia, and North Carolina. However, until further documentation, and considering it has remained undiscovered in habitat of high ecological quality in a region relatively well explored for Lampyrids (e.g., Barber 1951; McDermott 1953; Heckscher, 2010), this species must be considered precinctive to the Delmarva Peninsula. Peatlands occupied by *P. mysticalampas* should be significant conservation and preservation targets.

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James E. Lloyd reviewed this manuscript, made helpful suggestions for improvement, and examined specimens of *P. mysticalampas*. Jennie E. Heckscher provided helpful comments on an earlier draft. Matthew R. Halley assisted with the photography and collection of specimens. Stevens Heckscher provided advice on Latin translations. Most specimens collected from 2004-2008 were secured while conducting zoological surveys for the Delaware Natural Heritage and Endangered Species Program, Delaware Division of Fish and Wildlife. Rob Gano permitted night access to Nanticoke State Wildlife Area. The name of this species was in part inspired by Florence Jurretta Murray who relished the mystique of fireflies throughout her life.

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